

REMARKS

Claims 1-4 and 6-22 have been examined and remain in the Application. Claim 5 is cancelled. Claims 1-4 and 6-22 are rejected under 35 U.S.C. § 103(a).

A. 35 U.S.C. § 103(a): Rejection of Claims 1-4 and 6-22

1. Grumbine

The United States Patent and Trademark Office (USPTO) rejects claims 1-4, 6-7, 9-15, and 18-20 under 35 U.S.C. § 103(a) as being unpatentable over United States Patent No. 6,068,787 issued to Grumbine ("*Grumbine*").

Claim 1 is amended to clarify the claimed invention. Claim 1 relates to a method for removing a particle from the surface of a metal plug formed in a via. Claim 1, lines 1-2 of the marked claims. A first agent is introduced to the metal layer. Claim 1, line 3. The metal layer is polished with the first agent. Claim 1, line 4. After the metal layer has been polished, a second agent comprising hydrogen peroxide is introduced to the surface of the metal plug and at least one particle is removed from the surface of the metal plug. Claim 1, lines 5-7.

Grumbine does not teach or suggest amended claim 1. Instead, *Grumbine* relates to a chemical mechanical polishing slurry that includes hydrogen peroxide. The "chemical mechanical polishing slurry is useful alone or in combination with other chemicals and abrasives for polishing metal layers and thin films associated with semiconductor manufacturing." *Grumbine*, col. 1, lines 13-14. The USPTO concedes that "Grumbine et al. does not disclose that rinsing occurs during polishing." Office Action dated July 5, 2000, p. 3, and Final Office Action dated February 6, 2001, page 3. However, the USPTO asserts either it is "within the scope of one of ordinary skill in the arts to employ slurries containing hydrogen peroxide subsequent to another slurry to achieve respective portions of the polishing step" or that *Grumbine* in view of U.S. Patent

No. 5,990,012 issued to Robinson et al. ("*Robinson*") teaches a rinsing operation occurring during a polishing operation. Each of these assertions is addressed below.

Example 2, relied upon by the Examiner, relates to slurry compositions that include hydrogen peroxide for *polishing* a surface. In particular, this passage states "[w]e have discovered that a composition including an oxidizer and a catalyst is capable of *polishing* a multiple metal layer comprising tungsten and titanium at high rates while exhibiting an acceptable low polishing rate towards the dielectric layer." *Grumbine*, col. 10, lines 12-16. Nowhere in this passage does it indicate that hydrogen peroxide is used to *rinse* a surface *after a metal layer is polished*. Accordingly, independent claim 1 is not obvious based upon *Grumbine*. Independent claims 9 and 18 are also not obvious since these claims also include a rinsate that comprises hydrogen peroxide which is used after polishing the metal layer.

Since claims 2-4 and 6-7 depend from claim 1, these claims contain at least the limitations of claim 1 and are also not obvious based upon *Grumbine* for the reason presented that claim 1 is not obvious. Additionally, since claims 10-15 depend from claim 9, claims 10-15 contain at least the limitations of claim 9 and are also not obvious based upon *Grumbine*. Moreover, claims 19-20 depend from claim 18 and also contain at least the limitations of claim 18 and are also not obvious based upon *Grumbine* for at least the reasons presented above. Withdrawal of the rejection under 35 U.S.C. § 103(a) to claims 1-4, 6-7, 9-15, and 18-20 is requested.

2. *Grumbine in view of Robinson*

a. *The invention is not taught or suggested by the combination of Grumbine and Robinson*

Claims 8, 16-17, and 21-22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Grumbine* as applied to claims 1-4, 6-7, 9-11, 13-15, 18, and 20, in view of *Robinson*. Claims 1, 9, and 18 from which claims 8, 16-17 and 21-22 depend, are not

obvious based upon the cited references because *Robinson* fails to teach or suggest rinsing the surface of the metal plug after the metal layer has been polished as in claim 1, lines 5-6; claim 9, lines 5-6; and, claim 18, lines 3-4.

Robinson relates to the chemical mechanical polishing of hydrophobic materials. In the background of the invention in *Robinson*, a conventional chemical mechanical polishing apparatus is described in the following manner:

In a conventional CMP apparatus, a semiconductor substrate to be polished is mounted on a polishing block which is placed on the CMP machine. A polishing pad is adapted to engage the semiconductor substrate carried by the polishing block. A *cleaning agent* is dripped onto the pad continuously during the polishing operation while pressure is applied to the semiconductor substrate.

Robinson, col. 1, lines 44-50. There are two problems with the USPTO's reliance upon this passage to support its obviousness rejection. First, one skilled in the art understands that the cleaning agent is a slurry, not a rinsate as stated at col. 1, lines 66-67 through col. 2, lines 1-3 of *Robinson*. Second, the claimed invention relates to rinsing the surface of a metal plug after the polishing operation has been completed whereas *Robinson* indicates that a cleaning agent such as a slurry is applied during a polishing operation. The undersigned has reviewed *Robinson* and cannot find a statement that teaches or suggests rinsing the surface of a metal plug with a solution that includes hydrogen peroxide after polishing the metal layer. Therefore, Applicants respectfully submit that independent claims 1, 9, and 19 are not obvious based upon *Grumbine* in view of *Robinson*.

b. There is no motivation to combine *Grumbine* and *Robinson*

Applicants respectfully assert that the Examiner failed to adequately set forth an obviousness rejection under 35 U.S.C. § 103(a). In the case of *In re Rouffet*, 149 F.3d 1350 (Fed. Cir. 1998), the Court of Appeals for the Federal Circuit ("Federal Circuit") specifically set forth the requirements that must be met by an examiner when an

obviousness rejection is made based upon a combination of references. "An examiner must show reasons that the skilled artisan, confronted with the *same* problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." *Id.* at 1357. Merely indicating that the invention is obvious to one with ordinary skill in the art based upon the combination of references is wholly inadequate. *Id.*

The Federal Circuit stressed the importance as to why examiners must clearly explain the motivation to combine references instead of simply stating that a motivation exists:

If such a rote invocation could suffice to supply a motivation to combine, the more sophisticated scientific fields would rarely, if ever, experience a patentable technical advance. Instead, in complex scientific fields, the Board [of Appeals and Interferences] could routinely identify the prior art elements in an application, invoke the lofty level of skill, and rest its case for rejection. To counter this potential weakness in the obviousness construct, the suggestion to combine requirement stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness.

(Emphasis added.) *Id.* Neither the first Office Action nor the final Office Action adequately explains a basis for combining these references. For example, the Examiner stated that "[i]t would have been within the scope of one of ordinary skill in the art to employ the process of Robinson et al. for its disclosed intended purpose to achieve the metal layer polishing step of Grumbine et al." Final Office Action dated February 6, 2001, page 3. This explanation does not satisfy the suggestion to combine requirement set forth above for at least two reasons. First, the rinsing operation of the claimed invention occurs *after* the polishing operation. Independent claim 1, lines 5-6; independent claim 9, lines 5-6; and, independent claim 18, lines 3-4. Second, the Federal Circuit requires that the Examiner's basis for combining the references relate to the *same* problem as that which confronted the inventor. One problem that the inventors confronted was removing particles from a metal plug after the surface of the metal plug

has been polished with a slurry. Application, page 3, lines 17-20. In contrast, *Grumbine* sought to overcome the problem of slurries used for polishing surfaces in which the slurry had potential integrated circuit contaminants. *Grumbine*, col. 2, lines 59-61. Additionally, *Grumbine* sought to overcome the instability and inactivity associated with conventional slurries. Col. 2, lines 61-64. *Robinson* sought to develop a polishing solution such as a slurry that wetted either the fixed-abrasive pad or the polishing surface sufficiently to activate chemical mechanical polishing without altering the necessary chemical composition of the polishing solution to the point that it no longer serves its role in the chemical portion of the chemical mechanical polishing. *Robinson*, col. 3, lines 43-48. Neither *Grumbine* nor *Robinson* teach or suggest the claimed invention since both of these references relate to slurries, not rinsates. Therefore, the USPTO has failed to adequately demonstrate that *Grumbine* is properly combined with *Robinson*.

For the above-stated reasons, the Applicants assert that claims 1, 9, and 18 are not obvious based upon *Grumbine* alone or *Grumbine* in combination with *Robinson*. Since claim 8 depends from claim 1, claim 8 has at least the limitations of claim 1. Therefore, claim 8 is not obvious. Moreover, since claims 16-17 depend from claim 9, these claims have at least the limitations of claim 9; therefore, claims 16-17 are also not obvious. Additionally, claims 21, and 22 depend from claim 18 and have at least the limitations of claim 18; therefore, claims 21, and 22 are not obvious. Withdrawal of the rejection under 35 U.S.C. § 103(a) to claims 8, 16, 17, 21, and 22 is respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

CONCLUSION

In view of the foregoing, it is believed that all claims now pending are now in condition for allowance and such action is earnestly solicited at the earliest possible date. If there are any fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666. If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,

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Dated: 5/17/01

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CERTIFICATE OF MAILING:

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 5/17/01
Nadya Gordon Date

Attachment: VERSION WITH MARKINGS TO SHOW CHANGES MADE

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

1 1. (Three Times Amended) A method of removing a particle from a [metal]
2 surface of a metal plug formed in a via comprising:
3 introducing a first agent to a metal layer;
4 polishing the metal layer with the first agent; [and]
5 after polishing the metal layer, introducing a second agent comprising hydrogen
6 peroxide to [a] rinse the surface of the metal plug; and
7 removing at least one particle from the surface of the metal plug.

1 9. (Three Times Amended) A method of removing at least one particle from a
2 [portion] surface of a metal [layer on] plug disposed over a substrate comprising:
3 depositing a slurry onto a metal layer over the metal plug [the substrate];
4 polishing the metal layer [and the substrate]; and
5 after polishing the metal layer, rinsing [a] the surface of the metal plug with a
6 solution comprising hydrogen peroxide.

1 18. (Three Times Amended) A method comprising:
2 polishing [the] a metal layer over a conductive plug with a slurry; [and]
3 after polishing the metal layer, introducing a rinsing solution onto [a] the [metal]
4 conductive plug, the rinsing solution [comprising] comprises hydrogen peroxide.